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SUMMARY OF DOCTORAL THESIS

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Title: Determinants of small-scale farmers' perception to soil erosion and their adoption of land management practices in north-western Ethiopia

(エチオピア北西部における小規模農家の土壌侵食に対する認識
および土地管理策の選択に関する決定要因)

Soil degradation—mainly through water erosion—represents a significant livelihood challenge in the highlands of the north-western Ethiopia. Annual soil erosion rates as high as 42 Mg ha⁻¹ and more have been reported on cultivated lands. Over the last four decades, the government of Ethiopia with the support of several international and bilateral agencies have been promoting various types of land management technologies (e.g., soil bund, *fanya juu*, stone-faced soil bund, application of inorganic fertilizer) to control soil erosion and improve rural livelihoods. In spite of the multiple technologies being promoted in the country, small-scale farmers' investment remains unsatisfactory, or it is limited to traditional techniques (e.g., traditional stone bund, agroforestry, drainage channel, application of manure).

It is found that, there exist a widespread perceptions of the on-going soil erosion problem among small-scale farmers' in the Upper Blue Nile Basin, Ethiopia. Yet these perceptions are only marginally translated into stimulating a sustained use and widespread uptake of sustainable land management (SLM) technologies. This is due to the fact that investment decisions (i.e., 'to use and not to use', and 'how much to use') of farmers on such technical solutions are mainly directed and conditioned by a series of factors—institutional, socio-economic, and biophysical. In order to develop appropriate SLM strategies for the study region, there is a need to investigate farmers' perceptions of soil erosion severity and examine their corresponding actions to alleviate its perceived effects. This will be helpful to identify and design effective SLM programmes and support services. As a result, the study is aimed at examining small-scale farmers' attitude towards soil erosion and their adoption of land management practices in the north-western Ethiopia. Specifically, the objectives of this study are threefold: (1) to investigate how farmers perceive the severity of soil erosion and to explore the principal determinants of variations, (2) to analyze the underlying factors that affect the adoption of SLM technologies, and (3) to assess the motivations of farmers to establish agroforestry, the respective determinants and the context in which tree planting has expanded. This study comprises five chapters.

Chapter 1 presents the introductory section of this study. It sets out an overview of the background for the study, focusing on physical features, climate, economy, population, crop sector, farm size, policy, and the soil erosion problem and the country's experience in soil conservation activities. Subsequently, it presents the study objectives, concepts and definitions, theoretical and conceptual frameworks, and outline of the thesis.

Chapter 2 investigates how smallholder farmers perceive the severity of soil erosion in the Upper Blue Nile Basin, Ethiopia. The analysis is based on a detailed survey of 300 households and 1,010 plots operated by these households in three watersheds. Descriptive statistics and a partial proportional odds model were applied to analyze factors that affected farmers' perceived soil erosion severity at the plot-level. Results showed that variables such

as plot distance from the residence, plot shape and position on hill slopes affected farmers' perceptions of soil erosion severity, as well as the amount of rainfall during the growing season. Farmer interaction with extension service agents also affected farmers' perception of soil erosion severity. Despite their expected importance, education and number of livestock owned had no effect on the farmers' perception of soil erosion. The results indicate that farmers' perceptions generally match empirical and theoretical findings on soil erosion determinants; thus, farmers should be considered as important partners not only to counter soil erosion, but also to obtain local expertise on soil erosion severity and restoration of degraded land.

Chapter 3 analyzes the underlying factors that affect the adoption of SLM technologies in the Upper Blue Nile Basin. A detailed survey of 300 households and 1010 farm plots was conducted. Data were analyzed by using both descriptive and econometric analyses. Results show that farmers' adoption of interrelated SLM measures depended on a number of socio-economic and farm-related factors in combination with the characteristics of the technologies themselves. For example, plot size and the availability of labor, as well as the gender of the household head, affected which SLM technologies were adopted by certain types of households. The adoption of SLM measures depended on the adaptive economic capacity of the farmers, which can be quite diverse even within a small region and can differ from the adoption potential in other regions. Our results suggest that SLM policies and programmes have to be individually designed for specific target groups within specific regions, which in turn means that "one size fits all" and "across the board" strategies—which are quite common in the field of SLM—should be abandoned by development agencies and policymakers.

Chapter 4 examines why and which factors determine the decisions of small-scale farmers to grow short-rotation woodlots on their land as an additional source of livelihood and as a land management option. Data used in this study were collected from a survey of 200 randomly selected households in the region. A Tobit regression model was used to determine predictor variables for farmers' decisions to allocate land to planting *Acacia decurrens* (J.C. Wendl.) Willd. and at what density trees are planted on the respective plots. The most important motivations for planting *A. decurrens* were income, soil fertility management, and soil and water conservation. Having a male head of household, long distance to markets and plots being on marginal land, among other factors, increased the allocation of land to *A. decurrens* woodlots. Having a male head of household, access to credit and plots being on marginal land, among other factors, increased tree planting density. Age had a negative effect on both allocation of land to woodlots and tree density, whereas farm size had an inverted U-shaped relationship with both decisions. These results suggest that wider expansion of *A. decurrens*-based plantation systems could be achieved through improving extension, credit access and road infrastructure to connect small-scale farmers to markets and finance.

Chapter 5 provides a general synthesis of the whole thesis, including conclusions, policy implications, limitations of the study, and avenues for further research.

The findings of this study showed that small-scale farmers' perceived soil erosion severity and adoption of SLM technologies were conditioned by a number of socio-economic, biophysical, institutional and farm related factors in combination with the characteristics of the technologies themselves. These findings allow deriving policy recommendations to enhance voluntary uptake of SLM technologies by small-scale farmers. Thus, SLM programmes and support services should give attention to "participatory" approach to ascertain farmers' attitudes about soil erosion and their preferences of counter measures. This will in turn allow them to capitalize on localized knowledge and design policies and strategies that promote restoration of degraded lands.